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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 09/689,930      | 10/13/2000  | Chung-Shi Liu        | TS99-656            | 7448             |

7590 09/04/2002  
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POUGHKEEPSIE, NY 12603

EXAMINER

SAGAR, KRIPA

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
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1756

DATE MAILED: 09/04/2002

6

Please find below and/or attached an Office communication concerning this application or proceeding.

MFS 6

# Office Action Summary

Application No.

09/689,930

Applicant(s)

LIU ET AL.

Examiner

Kripa Sagar

Art Unit

1756

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 04 June 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 October 2000 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## **DETAILED ACTION**

### ***Response to Amendment***

1. The amendment filed on 6/4/02 has been entered.

The amendment is sufficient to overcome the rejections under 35 USC § 112.

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-7,9-17, 19-27,29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jang in view of Tobben and further in view of Orvek.

For details and grounds of rejection please see earlier office action paper 4, #4.

4. Claims 8,18 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jang in view of Tobben and further in view of Orvek as applied to claims 1-7,9-17,29-27,29 and 30 above, and further in view of Pu.

For details and grounds of rejection please see earlier office action paper 4, #5.

### ***Response to Arguments***

5. Applicant's arguments filed on 6/4/02 have been fully considered but they are not persuasive.
6. Applicant has summarized the novelty of the invention (p.14) and claims that it consists of the "use of two layers of positive tone photoresists" in the fabrication of a self-aligned dual damascene structure. The bottom resist used for etching the via is

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sensitive to I-line (365nm) radiation. The top resist layer is sensitive to DUV (248nm) radiation. Applicant asserts that the "high contrast" resist system has selective etch resistance, thermal stability, good adhesion and provides easy processing in a two-step etch.

7. In response to the office action paper 4, #4 applicant argues that

(a) Jang's invention is directed towards forming barrier layers around the conductive layer in the trench and via, while the current application is towards a two-resist system with different wavelength sensitivities.

(b) Tobben removes the first layer of photoresist before applying and patterning the second photoresist layer. Thus, the process does not teach forming a photoresist layer on an exposed and developed photoresist layer. Further, Tobben's disclosure is directed towards a DARC (dielectric anti-reflective coating).

(c) Orvek does not teach a trench-and-via patterning using a DUV resist on a mid-UV resist. The two-layered resist is used only to form an interconnect structure.

(d) The combination does not produce the resist-on-resist structure of applicant's invention because Jang and Tobben remove the first resist layer, while Orvek does not pattern the first layer before applying the second layer.

8. In response to applicant's arguments against the references individually, one cannot show non-obviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Further the applicant's arguments (a-d) are examined below.

(a) Jang teaches all the elements recited in claims 1-7,9-17,19-27,29 –30 as shown with appropriate citations in the earlier rejection. The elements of the claims not taught by Jang are the use of a top dielectric and the two resist system.

(b) Tobben teaches the use of a top layer dielectric and

(c) Orvek teaches the use of a two-resist system in etching an interconnect structure. It states that the process may be used in forming interlevel interconnects where selective etching is required. Specific application includes the metallization process (9;43-10;10).

(d) There are numerous process variations available in forming a stepped profile in a resist stack. It is well known and common practice to retain the first resist layer while forming the second resist layer on top. This is a process design and has been recognized as known prior art by applicant ( see for example applicant's specification, p. 2-3 with reference to US Pat. 5877076 to Dai ).

It would have been obvious to one of ordinary skill in the art to combine the teachings of Jang, Tobben and Orvek to arrive at the applicant's structure and process. This would comprise using Jang's process with the addition of Tobben's DARC and using the DUV and MUV resists of Orvek to fabricate the dual damascene structure.

The motivation for the combination as stated earlier arises from (a) the fact that the three inventions are directed towards forming interlevel interconnections; Jang's and Tobben's disclosures are specifically directed towards forming self-aligned dual damascene structures, (b) Tobben's assertion that the use of a DARC leads to

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improved feature definition in the resist and subsequent etching of the dielectric layer and (c) Orvek's teaching that the use of the DUV resist on top of the MUV resist increases the image resolution in the exposure + development step and more importantly it provides *enhanced selectivity* during dry etching of the stepped features.

9. In response to the rejection of claims 8, 18 and 28 applicant has argued that since the combination of Jang, Tobben and Orvek cannot produce applicant's invention, hence the etch chemistries of Pu in combination with Jang, Tobben and Orvek cannot teach the current invention.

It has been shown above that (a) it is conventional in the dual damascene process to use two resist layers (b) to use a top dielectric layer (c) to use DUV and MUV resists to increase etch selectivity and (d) to retain the first patterned resist layer when applying the second layer. Motivation for combining the teachings of the cited references have been provided to show that the applicant's invention is fully disclosed by the combination. Thus the etch chemistries of the applicant are also taught as prior art by Pu. Motivation for combining Pu's teachings with those of Jang, Tobben and Orvek has already been stated in the earlier office action.

### ***Conclusion***

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

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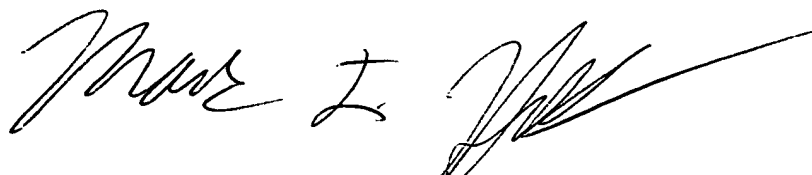
mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kripa Sagar whose telephone number is 703-605-4427. The examiner can normally be reached on 8:00AM--5:00PM (M-F).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark F Huff can be reached on 703-308-2464. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

MH/ks  
September 2, 2002



MARK F. HUFF  
SUPERVISORY PATENT EXAMINER  
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